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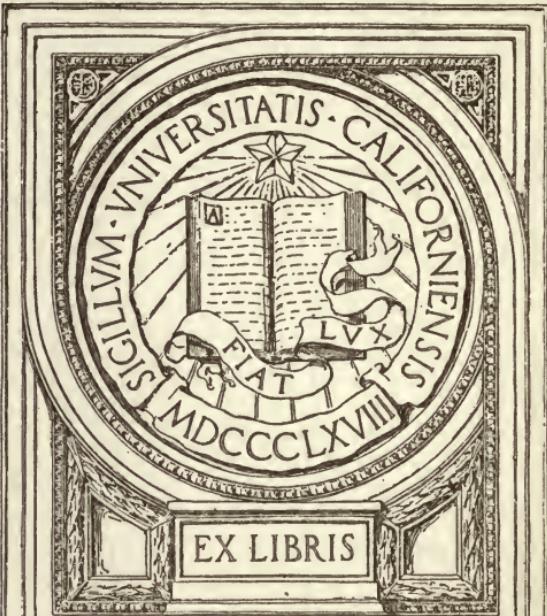
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THE IMPORTANCE OF COMPARATIVE FIELD
TESTS WITH SUGAR BEET SEEDS AND
HOW TO CONDUCT THEM

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Part I. Field Tests



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AUGUST 1911
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Directions for Tests With Different Varieties of Sugar Beet Seed by the Standard Method.

Comparative tests with sugar beet seed should be carried on by every factory for the purpose of establishing the merits of each variety and in order to ascertain from actual returns, which type is the most remunerative to the farmer and which to the factory.

It is a well-known fact that the sugar beet is very sensitive to all agencies influencing the growth of plants, such as atmospheric conditions, character of soil, cultivation and others, and quite frequently a barely noticeable deviation of one or the other produces a material difference in yield or sugar content of a certain variety. Therefore, in order to properly judge the relative value of various sugar beet types, it is essential that they be grown and tested under as nearly uniform conditions as possible.

Equally as important as uniformity of soil, climatic and other external conditions, are the following points, in connection with the standard test method:

1st: The planting, cultivation and general care of the test field should be handled as nearly alike, as this work is performed in the field of the average beet grower.

2nd: The test field should be as uniform as possible in character of soil and subsoil, also as regards the preceding crop, fertilization and preparation of the ground. Land which has been previously used for experimental work, garden, dumping ground for rubbish, etc., is not fit for these test plots. The field selected for the standard test should be most carefully prepared.

All preparatory work, especially the deep plowing, should be performed under a right angle to the beet rows. The plowing should be done by one man with one and the same plow.

the operation of lifting. This applies especially to the center rows which are used for analysis and the tonnage test.

Much can be gained by employing throughout the season the same laborers for all the work in connection with these test plots, providing this is at all feasible. I doubt, however, that many will be in such a fortunate situation, especially out West.

9th: The test fields must be frequently inspected and any irregularities or differences in germination, uniformity of coming up, growing energy, vitality, appearance of and damage by parasites and diseases, disease resistance and other features that may present themselves to the student and close observer, must be carefully and immediately recorded.

10th: The sugar content and yield of a variety are greatly dependent on the number of plants per square unit and the distance between beets. The same variety will show marked differences in both, though growing under as nearly identical soil, climatic and other conditions, as possible, when there are only 28,000 or 39,000 beets growing on an acre. A similar difference will be observed in case of the same number of beets to the square unit, but when they are unevenly distributed, i. e., a great deal depends whether the plants grow uniformly all over the surface of a field or whether there are places of a dense stand and then again bare spots. It is therefore recommended that for the determination of sugar and tonnage only such beets be used, which have matured in a row or in sections of rows of uniform stand. Wherever this condition exists the theoretical yield of a variety is ascertained by multiplying the average weight of the beets, harvested from such spots with normal stands, with the calculated number of beets per acre. This method is justified and generally accepted, since the number of beets per acre is mostly dependent on the soil and growing conditions, and **not** on the character of the beet type. Marked differences in germination power and vitality from the outset are always recorded during the first growth of the crop. Whenever great differences occur in the stand of a test field, it is advisable to remove the beets from the uneven spots the day before the beets are lifted for the test, leaving in the plots only those beets which matured in rows of a uniform stand. By proceeding in this manner errors resulting through the addition

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of beets which grew under abnormal conditions, can be fully eliminated.

Should through some cause or another the entire test field show a very uneven and faulty stand, the selection of the test beets must be left to the judgment of the investigator, and a careful count of the beets in each test plot is necessary so that the records show the prevailing conditions most accurately, furnishing at the same time an explanation for the results of the sugar and tonnage tests of these plots. The results from test fields which have a uniformly thin stand, but no bare spots of any consequence, while not of as great value as of a uniformly good stand, can still be used for a fairly accurate calculation of the yield of a variety. In this case the average between the theoretical number of beets per acre and the actually counted number of beets per acre, is ascertained, and this figure is then multiplied with the average weight of the test beets. The results obtained from such irregular test fields are not conclusive on the merits of a variety and can only be used for comparison with others grown under the same conditions on the same field.

11th: The larger the number of beets which are used for the sugar determination, the more accurate are the results obtained. The usual equipment and arrangement of a factory laboratory, however, limits the number of beets to be tested, and careful investigation has proven, that it is not necessary to use all the beets from each test plot for analysis.

The general custom for the selection of beets for laboratory use is the following: After removing all beets grown in open spaces and in outside rows, and others not standing in continuous rows, the number of the remaining beets in each plot is ascertained, and accordingly, every fourth, sixth or tenth beet may be selected for the laboratory test. Just what percentage of the normally grown beets should be selected cannot be prescribed, as this depends entirely on the stand in the test plots; all that is required is a sufficiently large number for the purpose of obtaining the most accurate results. Some beets will always have to be discarded after they have been pulled, on account of broken roots, injuries by insects or disease, or for other causes which cannot be detected until the beets have been lifted. It is better to have too many beets than not enough.

12th: The most advisable method for the sugar determination is the "Hot Water Digestion," and for the sake of uniformity and comparison of results from the different sections of the United States, this method, and no other should be used in the analytical work. The pulp should be as fine and uniform as possible, and the use of boring machines is not recommended, as too small a section is removed from each beet, and also because the sugar content of such a small section is not a fair representative of the sugar content of the entire beet.

13th: Several hundred beets produce a considerable quantity of pulp. As it is impossible, for the average factory laboratory, to digest the entire amount, only a sample thereof will be analyzed, and the selection of this sample is a feature of great moment. The following method for securing this sample is recommended: Divide the entire quantity in two parts—A and B; mix each thoroughly and then divide each again into A1, A2 and B1 and B2. Then mix thoroughly A1 with B1 and A2 with B2, then re-divide (A1 and B1) and (A2 and B2) and repeat this manipulation 10 to 15 times for about 15 minutes. Finally about 5 to 7 samples are taken from this mixture and the sugar in each one is determined. Since every seed variety is from 3 to 5 times represented in a test field, from 15 to 30 individual determinations of sugar are thus obtained of each by this method.

14th: As errors in the reading of the polariscope are very common, and occur even with the best chemists, the use of 4 to 5 samples is far superior to the use of one, though the latter may represent 4 times the weight of any single one. The more readings the smaller the margin of errors.

In order to be able to form reliable conclusions of the results of these tests the greatest accuracy in connection with every branch of the work in the field as well as in the laboratory is of prime importance; without it, more harm than good might come from them.

A supplementary edition treating the work in the laboratory in detail, and the method of calculating and determining the results of the seed tests will be issued later in the season.

Los Angeles, California, February, 1911.

be tested, the use of a "standard type" is absolutely necessary; in case of only a few varieties (4 to 6), the standard type may be omitted, and instead the test rows of the others should be repeated once or twice more—making 4 or 5 series of plantings, instead of only 3.

6th: The size of the test fields greatly depends upon the degree of accuracy of results which are expected from the tests. For an accurate determination of the sugar content an area of approximately 120 to 150 square yards is sufficient. For the yield test, at least three times that area is necessary, viz: approximately 450 square yards. When planning the size of the test field due consideration must be given to the labor at your command, as all the work in connection with the test field throughout the season should always, if at all possible, be performed in one day.

7th: As to the shape of the test field, same is dependent on soil conditions and slope; generally speaking an oblong parallelogram is most desirable, as it brings the different varieties in close proximity, thus making their growing conditions as nearly alike as possible. Each test plot, if one may thus designate each seeding of a variety, must consist of not less than three rows, and better five, the latter number increasing the accuracy of the results. For the determination of the sugar and yield of each variety only the **one** center row is used, in case of three row plots, and the **three** center rows are used in case of 5 row plots. The advantage of 5 row plots needs no further comment.

8th: The seeding and all other cultural labor should be performed in the same manner as is practiced in the open field, but the utmost care should be exercised to do all the work well and accurately. Where the seeding is done by hand instead of a Planet Junior hand seeder, uniform dropping of the kernels is absolutely necessary, and just as important is **a most accurate** spacing and thinning at a uniform distance throughout the test field. All varieties must be thinned at the same distance, and the width between rows must be likewise the same throughout the field. At the time of harvesting all beets must be uniformly topped and cleaned and the roots must not be broken off by

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Manure should be used from one stable only, so that it is the product of the same animals for a prolonged period. Never take horse manure from livery stables, or mix sheep and cattle manure. If possible, use the same pile of manure for the test field and see that it is most carefully and evenly distributed over the land in a uniform layer. Spread the manure **always** under a right angle to the direction in which you intend to plant your beet rows; it must be spread immediately and not allowed to lie in piles, for even a day, in the field; it must be plowed under as fast as it can be scattered.

3rd: In spite of the most careful selection and preparation of the test field, there may be spots which at the first glance plainly show that they differ in character from the general make-up of the field. Such places should not be included in the test at the time of harvesting. The beet rows should run in right angles to the plow furrow and the other preparatory operations, and parallel with the slope of the land. In case the character of the soil or its depth change in a given direction, the beets should be planted in the same direction.

4th: Even the most careful examination of the field and the greatest care in its selection do not always guarantee that conditions are absolutely uniform or will continue so during the growing season. Heavy rains, accidents during the irrigation, parasitic destruction and other agencies may cause great variations in the final results.

In order to eliminate the effects of such unavoidable occurrences as much as possible, and thus reduce to the lowest margin the errors resulting therefrom, each test must be repeated several times; and the more varieties are in the test the oftener the rows should be repeated. There should never be less than three series of each planting; one series of test rows is of no value, two of very little.

In order to obtain the most accurate results and data which can be directly compared, the use of one seed variety, as a "standard" is highly recommended. This standard variety is always seeded alongside every other variety included in the test, and the returns of the latter are then directly compared with the returns of the two "standard" varieties growing on either side. When a large number of varieties are to

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